

**A SATELLITE COMMUNICATION SYSTEM CONSTITUTED WITH  
PRIMARY AND BACK-UP MULTI-BEAM SATELLITES**

**ABSTRACT OF THE DISCLOSURE**

[0067] A satellite communication system for providing communications between user terminals and gateways constituted with  $m$  primary satellites. In one embodiment,  $n$  back up satellites are also provided. Further, each satellite, primary or back-up, is equipped to project  $N/m$  beams onto and across an area in a loosely-packed array manner.  $M$  of the  $m$  primary and  $n$  back-up satellites collectively create  $N$  beam spots to cover the area. Moreover, each sub-area is covered by a beam spot separated from another sub-area covered by another beam spot by one beam width. Each satellite is also equipped to facilitate communication over 1 of  $m$  band of frequencies on one beam. AS a result, any of the  $m$  primary satellites may be efficiently replaced on demand by a selected one of the  $n$  back-up satellites. The gateways and user terminals are configured to communicate signals through or with both or either the primary and back-up satellites.